POLLUTION PREVENTION AT LOS ALAMOS NATIONAL LABORATORY
Sorting and Segregating Potential Low-Level Radioactive Waste From TRU Waste at TA-55

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Background

Radioactive waste from Los Alamos Nation Laboratory's (LANL) Plutonium Processing Facility, TA-55 PF-4, is assayed by Safeguards and Security (S&S) personnel to determine the amount of Special Nuclear Material (SNM) within the waste. The amount of SNM within the waste is reported as an equivalent amount of Pu^{239}. Radioactive waste items that contain enough SNM to be attractive for diversion are held within the facility for further processing. Radioactive waste items that contain smaller amounts of SNM are categorized as Attractiveness Level E and are disposed as radioactive waste.

Historically all TA-55 process waste has been considered transuranic (TRU) waste because the high background radiation present in PF-4 doesn't allow the Non-Destructive Assay (NDA) equipment to achieve sufficient detection sensitivity for determining when an individual waste item is low level waste. Because of this all wastes are considered TRU wastes and individual waste items are packaged in drums without regard to the SNM content of the waste.

The Challenge

The TRU waste drums are transported to TA-54 for storage prior to certification and shipment to WIPP. Due to the limited storage capacity at TA-54 Area G, Solid Waste Operations (SWO) personnel assayed 64 low-mass TRU drums in the lower background environment of TA-54. Twenty-four (37%) of those drums were determined to contain LLW. Another recent study at TA-54 determined that 10 (41%) out of 24 stored metal boxes of TRU waste are actually LLW. Obviously a significant portion of the routine TRU waste produced is actually LLW.

The need to accurately discriminate between LLW and TRU waste has been recognized by Nuclear Materials Technology (NMT) personnel for some time. A joint proposal from the materials assay group (NMT-4) and the waste management group (NMT-7) was received for Generator Set Aside Fee (GSAF) funding in January 2001. That proposal called for the establishing an assay system in a low-background area within the fenced portion of TA-55. That assay system was to be sensitive enough to discriminate between TRU waste and LLW. However a suitable location for the proposed assay system could not be located and the proposal was withdrawn.

Since TA-55 is the largest producer of routinely generated TRU waste, the challenge for the Green Zia Team was to find a way to minimize the amount of LLW that is being mixed with the TRU waste or categorized as TRU waste at TA-55.

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Process Mapping

The team mapped the existing waste handling process to determine where waste minimization activities could/should be performed. The general process map for managing TRU waste is shown in Figure 1. Facilities to manage individual waste items waste only exist within TA-55 and WRRCF at TA-50. Because the waste is categorized and packaged at TA-55, managing the waste at TA-50 would involve opening previously closed waste containers. In order to eliminate the risk involved in opening waste containers the team decided to emphasize those activities that could occur before the waste containers were closed. For that reason the team focused on the waste processing activities at TA-55.

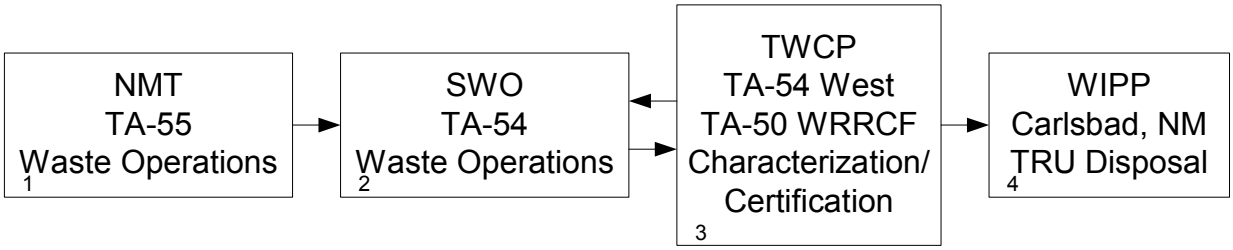

Figure 1. Process Map for TRU Waste Items

An expanded process map for NMT TA-55 Waste Operations is shown in Figure 2. The initial assay of the individual waste items is performed in step 1.6. The wastes are packaged in drums or boxes in step 1.9. Regardless of the outcome of the assay in step 1.6, items that are Attractiveness Level E are considered TRU waste and are managed as TRU waste from that point on. Figure 3 is the cause and effect diagram that shows the issues considered in determining the root cause. Those factors that were considered primary contributors to the categorization of LLW as TRU waste are circled.

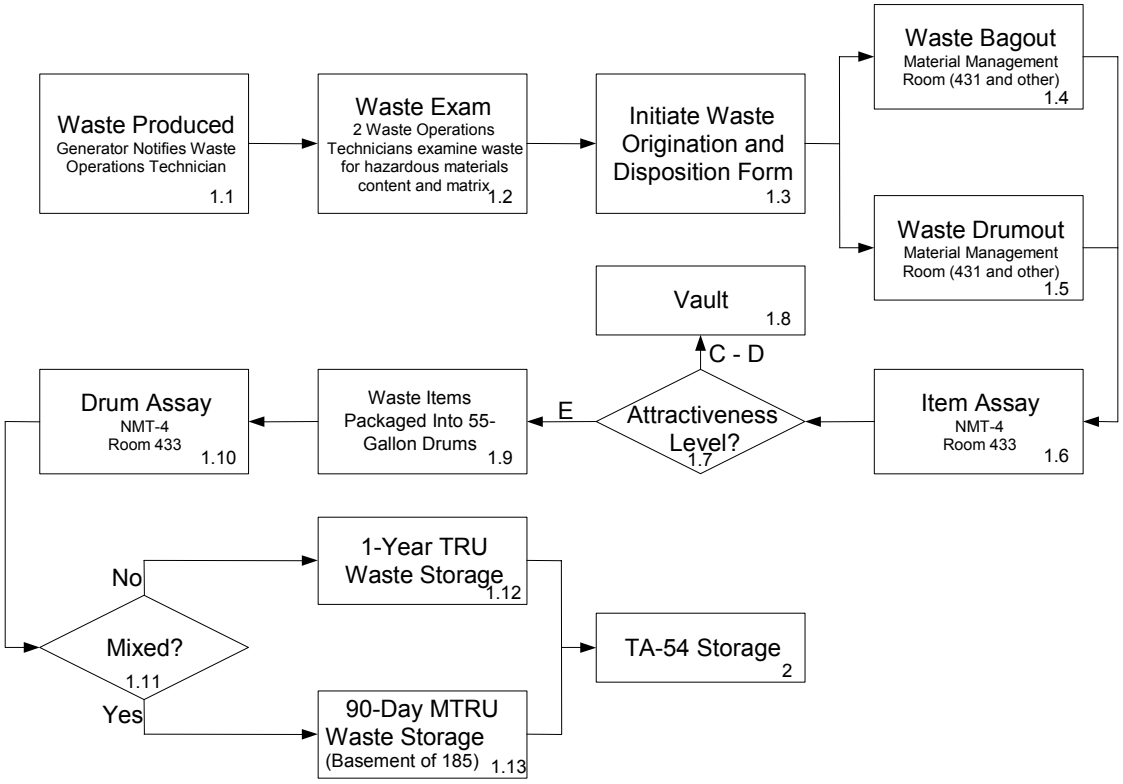

Figure 2. Process Map for TRU Waste Items at TA-55

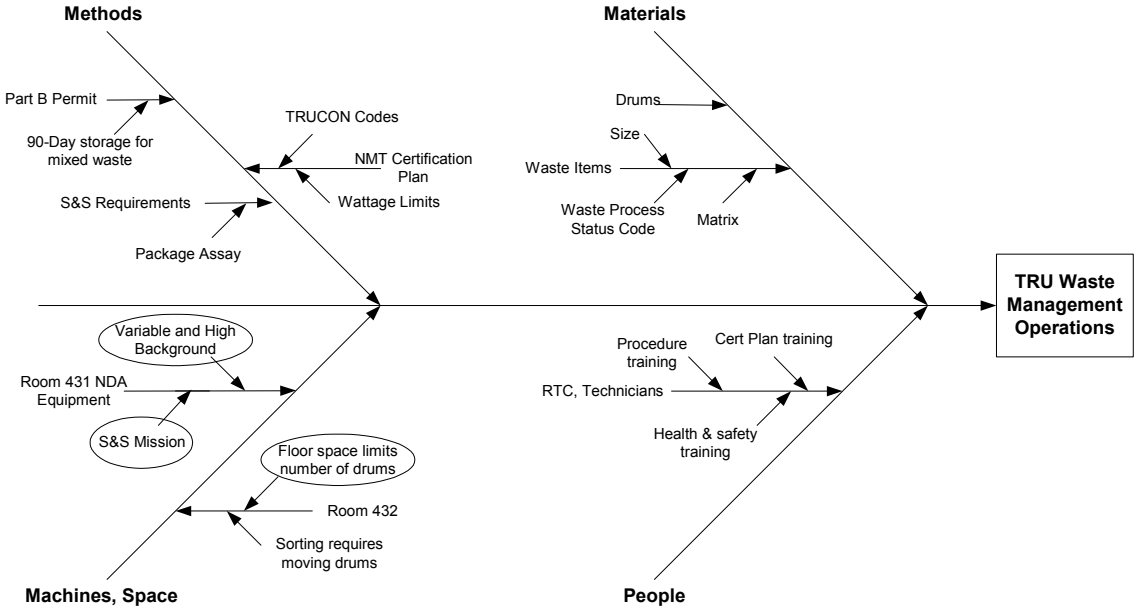

Figure 3. Cause and Effect Diagram for Sort and Segregation

Cost Analysis

The team reviewed the NMT transuranic (TRU) waste data from calendar years 1998, 1999, and 2000 to determine the number waste items and/or waste drums that potentially could be segregated and re-assayed in a lower background environment. Thirty-two (32) zero-count drums were produced during those three years. This yields an average of 2.2m^3/yr of waste that could be avoided if the zero-count drums were determined to be LLW. Table 1 shows the breakdown in waste volumes associated with the TRU waste's SNM material content. If the waste contents of an average drum weigh 112 pounds, the cutoff between LLW and TRU should occur between 0.01 and 0.1 grams of SNM. Therefore the greatest volume reduction expected should be approximately 2.8m^3/yr.

Table 1. NMT TRU Waste CY 1998 – 2000

SNM (grams)	Drums	Volume in m^3	Cumulative Volume in m^3	Yearly Volume
≤ 0.0	32	6.66	6.66	2.22
≤ 0.001	2	0.42	7.07	2.36
≤ 0.01	7	1.46	8.53	2.84
≤ 0.1	51	10.61	19.14	6.63
< 1	185	38.48	57.62	19.21

Because each waste drum contains waste items having varying concentrations of SNM, the team reviewed the disposition of individual waste items for the three-year period. Between 1998 and 2000, NMT produced 1752 waste items that were categorized as non-mixed TRU waste. Of those 1752 TRU waste items, 106 (6%) were determined to by the

S&S assay to contain 0-grams of SNM. However only 20 of those 106 0-gram items were placed in drums that were later determined to contain 0-grams of SNM (one item was placed in each of 20 drums along with other waste items). The remaining 12 (of the 32) drums that were determined by the S&S assay to contain 0-grams of SNM contained only items which had previously been determined to contained some amount of SNM. The remaining 86 0-gram items were placed in drums that were later determined to have greater that 0 grams of SNM due to the other waste items in the drums.

The average drum of TRU waste contains 42 kg of waste material. The total weight of the 106 0-gram items was 1772 kgs. If all the 0-gram items were placed together in drums of average weight, 42 drums would have been packaged with only 0-gram items during the 3-year period for a potential reduction of approximately $3m^3$/yr.

Management of TRU waste at TA-55 is detailed in the TA-55 Transuranic Waste Interface Document. That document specifies requirements for characterization of the waste, use of Acceptable Knowledge, visual examination, waste form, maintaining the TRU waste documentation, complying with the LANL Certification Plan, and the acceptable radiological, physical, chemical, gas generation and waste container properties. The required contents for TRU waste data packages are also included.

The FWO-SWO recharge rate for managing one cubic meter of Defense Programs TRU waste is approximately $1,000 per year. The Generator Set Aside Fee for that same cubic meter of TRU waste is $1,837. The estimated cost to certify a drum of TRU waste ranges from $5,600 to $72,000, depending upon the amount of characterization required and the amount of repackaging. Given that a drum a newly generated TRU waste does not require a lengthy characterization process and should not have to be repackaged, the lowest cost of $5,600/drum ($28,000/m^3) was assumed. Combined with the other cost, a cubic meter of newly generated TRU waste costs a minimum of $30,837 to manage. This does not include the cost to develop and maintain disposal space at the Waste Isolation Pilot Plant (WIPP) the cost to develop and maintain the TRU waste transportation system or the additional cost of managing the waste as TRU within PF-4. The potential reduction of $3m^3$/yr yields an estimated cost saving of approximately $90,000 for the first year. Additional savings could be realized if the program was expanded to include wastes containing between 0.01 and 0.1 grams of SNM.

Root Cause

Using the fishbone diagram (Figure 3) the team examined the materials, machines and methods associated with the management of TRU waste. The most significant causes for the categorization of LLW as TRU waste were determined to be the high and variable background in room 433 (the assay room), the lack of floor space for packaging waste and the use of NMT-4 S&S assay data for a waste determination. All the NMT radioactive process waste is categorized at TRU waste because the S&S assay system is not sensitive enough to distinguish between LLW and TRU even though the S&S assay is adequate for its intended purpose. The inability of the assay equipment to distinguish between LLW and TRU waste is due to the high and variable background radiation in

PF-4. The high and variable background radiation in PF-4 is due to the handling of Plutonium within the facility. The sensitivity of the assay equipment is not an issue with NMT-4 personnel because the assay instrumentation is sensitive enough to derive the necessary safeguards and security information.

Statement of Problem

The assay equipment used by NMT is unable to differentiate between LLW and TRU process wastes due to the high radiation background. Managing LLW as TRU waste is a waste of personnel, equipment, space and financial resources. The Green Zia Team needed to identify a process for differentiating and segregating NMT LLW from TRU waste.

Generating Process Alternatives

Options for identifying and segregating the LLW from the TRU waste were provided by team members and derived from previous meetings and discussions on the NMT GSAF proposal. The alternatives are not exclusive and include alternatives on what waste materials to sort and segregate and where the sort and segregate activity should be performed. Using the volumes in Table 1 as a guide, the team decided to focus the alternatives on those waste items that the initial NDA indicated contained 0-grams of SNM. The following options were discussed:

1. Segregate the zero-gram SNM waste items from all the PF-4 TRU waste.
2. Segregate the non-mixed zero-gram SNM waste items from the PF-4 TRU waste.
3. Segregate only the zero-gram SNM waste items that can be packaged into a 55-gallon drum.
4. Perform the segregation within PF-4.
5. Segregate the materials outside of PF-4 but within TA-55.
6. Locate/develop the required assay capability within PF-4.
7. Locate/develop the required assay capability within the fence at TA-55 but outside PF-4.
8. Use existing assay capabilities external to NMT and TA-55.

Rank Ordering of Alternatives

The team used a bubble up/bubble down process to select and combine the alternatives. Those alternatives that required facility modifications or additions were ranked lower because of the extensive time and approvals required implementing them.

One alternative provided the desired result and could be quickly implemented without facility modifications/additions. The selected alternative is a combination of alternatives 2, 3, 4 and 8. The selected option is to segregate all non-mixed zero-gram SNM waste items that can be packaged into 55-gallon drums and use the existing assay capabilities at E-ET to determine if those drums are LLW. The selected alternative is mapped in Figure 4 and starts with Box 1.6 of Figure 2.

At first glance correctly categorizing radioactive waste doesn't seem to prevent pollution or avoid waste generation. One cubic meter of waste is still one cubic meter of waste regardless of whether it is LLW or TRU waste. The pollution prevention benefits are derived from eliminating the generation of secondary waste and reducing the energy associated with managing the waste as TRU waste. The segregated LLW can go directly for disposal at TA-54. Sorting and segregating LLW from TRU at the point of generation removes the LLW from the extensive TRU waste certification requirements as well as reducing the amount of waste being stored as TRU and unnecessary transportation to and disposal at WIPP (342 miles). Once categorized as TRU waste, the waste package is managed as TRU waste until it is characterized and disposed. TRU waste is shipped to TA-54 for storage in a permitted storage facility. Once in storage the waste is subject to daily inspections and subsequent movements tracked. The waste is transported to TA-54 West for characterization assay and then moved back to TA-54 continued storage. Eventually the waste is transported back to TA-54 West for packaging and shipment to WIPP.

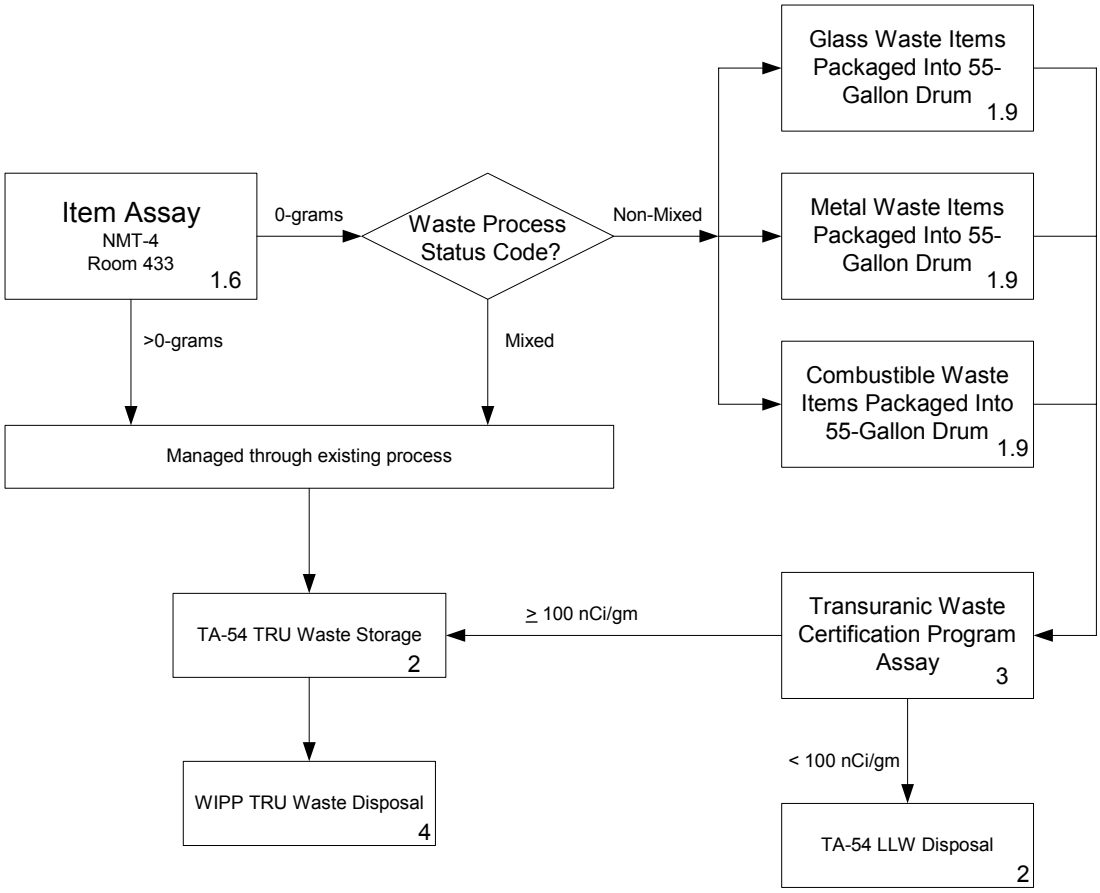

Figure 4. PF-4 TRU Waste Sort and Segregation Process Map

Action Plan

NMT-7 implemented the sorting and segregation program June 1, 2001. The program is limited to those non-mixed waste items that can be packaged in a 55-gallon drum. The waste items are being segregated into metal, glass, and combustibles (including rubber and plastic) waste streams. In the first week of operation two drums were filled with zero gram items. The Transuranic Waste Certification Program within E-ET will re-assay the drums of the zero-count items with WIPP-certified assay systems. If successful, the program could be expanded to include items with higher values of SNM and items that are large enough to require placement in a Standard Waste Box. Potential mixed TRU wastes are not included in the sort and segregation program to avoid the possible generation of mixed LLW that may not have a disposal path.

Milestone	Date
Implement Sort and Segregation of 0-gram waste items	June, 2001
Assay of 0-gram drums by TWCP	October, 2001
Issue letter report on TRU waste avoided for FY 2001	October, 2001

Issue letter report on TRU waste avoided for 1Q FY 2002	January, 2002
Issue letter report on TRU waste avoided for 2Q FY 2002	April, 2002
Issue letter report on TRU waste avoided for 3Q FY 2002	July, 2002
Review first year of the program and recommend improvements	July, 2002

In accordance with the recently WIPP-approved NMT certification program, RCRA codes are applied to the wastes from approximately 50% of processes within PF-4. This is a significant increase from previous years. The RCRA codes are applied to the wastes from glove boxes where RCRA regulated materials are presently used (few) and to the wastes from glove boxes where RCRA regulated materials were formerly used (many). While this approach is very conservative, it does not impact the management of TRU wastes since MTRU and TRU are managed and disposed through the same process. It does have an impact on those wastes that are segregated and determined to be LLW. Should the segregation of 0-gram items prove successful, the application of RCRA codes to LLW waste items from glove boxes where RCRA regulated materials were formerly (but not presently) used should be reviewed to determine if those waste items should not be RCRA regulated.